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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,853	09/29/2003	Katayun Barmak	YOR920030338US1	6319
29683	7590	07/13/2006		
HARRINGTON & SMITH, LLP 4 RESEARCH DRIVE SHELTON, CT 06484-6212			EXAMINER GRAYBILL, DAVID E	
			ART UNIT 2822	PAPER NUMBER

DATE MAILED: 07/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/674,853	Applicant(s) BARMAK ET AL.	
	Examiner David E. Graybill	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 27 April 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 19-53 is/are pending in the application.
- 4a) Of the above claim(s) 30-37 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19-29 and 38-53 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

The reply filed on 4-27-6 is not fully responsive to the prior Office action because it fails to conform to the provisions of MPEP 714.03:

37 CFR 1.111. Reply by applicant or patent owner to a non-final Office action.

(b) In order to be entitled to reconsideration or further examination, the applicant or patent owner must reply to the Office action. The reply by the applicant or patent owner must be reduced to a writing which distinctly and specifically points out the supposed errors in the examiner's action and must reply to every ground of objection and rejection in the prior Office action. The reply must present arguments pointing out the specific distinctions believed to render the claims, including any newly presented claims, patentable over any applied references. If the reply is with respect to an application, a request may be made that objections or requirements as to form not necessary to further consideration of the claims be held in abeyance until allowable subject matter is indicated. The applicant's or patent owner's reply must appear throughout to be a bona fide attempt to advance the application or the reexamination proceeding to final action. A general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references does not comply with the requirements of this section.

(c) In amending in reply to a rejection of claims in an application or patent under reexamination, the applicant or patent owner must clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. The applicant or patent owner must also show how the amendments avoid such references or objections.

Where a bona fide response to an examiner's action is filed before the expiration of a permissible period, but through an apparent oversight or inadvertence some point necessary to a complete response has been omitted - such as an amendment or argument as to one or two of several claims involved or signature to the amendment - the examiner, as soon as he or she notes the omission, should require the applicant to complete his or her response within a specified time limit (usually one month) if the period for response has already expired or insufficient time is left to take action before the expiration of the period. If this is done the application should not be held abandoned even though the prescribed period has expired.

Specifically, the 35 U.S.C 112 rejection of claim 38 directed to the term "the individual film layers" has not been addressed.

Because the response appears to be bona fide, but through an apparent oversight or inadvertence the response is incomplete, and in order to continue to afford applicant the benefit of compact prosecution, the

requirement to complete the response within a one month time limit is waived, the amendment is entered, and the claims are examined on the merits.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 38 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 38, there is insufficient antecedent basis for the language "the individual film layers."

In the rejections infra, generally, reference labels are recited only for the first recitation of identical claim elements.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 19, 20, 26, 28, 29 and 38-53 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Hegde (6136682).

In the title, and at column 2, lines 59-60 and 63-64; column 3, lines 24-44; column 4, lines 42-53; column 4, line 63 to column 5, line 13; column 5, lines 26-29 and 44-57; column 6, lines 63-64; and column 8, lines 25-58, Hegde discloses the following:

A diffusion barrier comprising a plurality of stacked sub-layers 12/14, each sub-layer having a thickness of about 0.4 to about 4.5 nm ("roughly 20 angstroms," "the thickness of the entire composite layer is roughly equal to 400 angstroms or less," and "a thickness of the composite barrier layer does not exceed 400 angstroms") which is predetermined to inhibit the formation of a crystalline lattice, to inhibit diffusion of a chemical species through the diffusion barrier; wherein the sub-layers are comprised of alternating layers of at least two different materials; where one of the materials is a metal nitride "TiN"; wherein the at least two materials selected to comprise the sub-layers are substantially immiscible; wherein the at least two materials selected to comprise the sub-layers exhibit mutual adhesion.

A multilayer diffusion barrier comprised of interfaces and atomically thin ("roughly 20 angstroms," "the thickness of the entire composite layer is roughly equal to 400 angstroms or less," and "a thickness of the composite barrier layer does not exceed 400 angstroms") films in which the surface

adhesion of each interface inhibits the formation of a lattice in of the individual film layers, inhibiting diffusion across the barrier, wherein thickness of each film is an a range of about 0.4 to about 4.5 nm; where the thickness of each film is in a range of about two atoms to about five atoms "the thickness of the entire composite layer is roughly equal to 400 angstroms or less"; where the thickness of each film is in a range of about 0.4 nanometers to about 1.5 nanometers ("roughly 20 angstroms," "the thickness of the entire composite layer is roughly equal to 400 angstroms or less," and "a thickness of the composite barrier layer does not exceed 400 angstroms").

A multilayer structure comprised of three or more sub-layers each having a thickness of about 0.4 to about 4.5 nm and an interface, wherein the interface of each of the sub-layers dominates the lattice formation on the sub-layers, preventing the formation of a lattice and grain boundaries, to inhibit diffusion of a chemical species through the structure; where each of the sub-layers is comprised of a metal.

A multilayer diffusion barrier for inhibiting diffusion of chemical species there through, comprising a plurality of stacked layers comprised of alternating films of at least two different metals, the thickness of each of said films being between about 0.4 to about 4.5 nm, which is predetermined inherently to substantially eliminate work hardening.

A multilayer structure comprised of at least two films forming a bond at an interface between each film, each film having a thickness of about 0.4 to about 4.5 nm, wherein the interface dominates a lattice formation, inhibiting the formation of a lattice and grain boundaries; alternating layers of at least two different materials; wherein each film has a thickness of about 0.4 to about 3.0 nm ("roughly 20 angstroms," "the thickness of the entire composite layer is roughly equal to 400 angstroms or less," and "a thickness of the composite barrier layer does not exceed 400 angstroms"); wherein the at least two materials exhibit mutual adhesion and are substantially immiscible; wherein at least one of the materials is a metal; wherein at least one of the materials is a nitride; wherein at least one of the materials "TaN" is a dielectric material; comprising three or more layers; inherently having flexibility and inhibited work hardening; which is a diffusion barrier between two materials that are otherwise capable of combining chemically or between a layer and a surface capable of chemically combining with the layer.

To further clarify the disclosure of three or more sub-layers, Hegde discloses "a composite or amorphous barrier layer," "a composite barrier layer," "a barrier layer," "an amorphous barrier material," and "a tantalum silicon nitride material but can be any other amorphous barrier material," and it is well settled that the term "a" or "an" ordinarily means "one or

more." Tate Access Floors, Inc., and Tate Access Floors Leasing, Inc., v. Interface Architectural Resources, Inc., 279 F.3d 1357; 2002 U.S. App. LEXIS 1924; 61 U.S.P.Q.2D (BNA) 1647 ((citing Tate Access Floors, Inc. v. Maxcess Techs., Inc, 222 F.3d 958, 966 n.4, 55 U.S.P.Q.2D (BNA) 1513, 1518 [\*\*32] (citing Elkay Mfg. Co. v. Ebco Mfg. Co., 192 F.3d 973, 977, 52 U.S.P.Q.2D (BNA) 1109, 1112 (Fed. Cir. 1999))).

To further clarify the disclosure of the structure inherently having flexibility, as cited supra, Hegde discloses the structure having no grain boundaries. Further, in the specification, at page 9, lines 11-13, applicant admits that flexibility is an inherent result of the structure having no grain boundaries, "Because there are no grain boundaries . . . resulting in . . . flexibility."

In the alternative, claims 19, 20, 26, 28, 29 and 38-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hegde (6136682).

Hegde is applied as applied to claims 19, 20, 26, 28, 29 and 38-53 supra. However, Hegde does not appear to disclose verbatim the claimed layer thickness limitations: "of about 0.4 to about 4.5 nm," "atomically thin," "a range of about 0.4 nanometers to about 4.5 nanometers." "a range of about two atoms to about five atoms," "a range of about 0.4 nanometers to about 1.5 nanometers," and "about 0.4 to about 3.0 nm."



Nonetheless, as cited, Hegde discloses, "roughly 20 angstroms," "the thickness of the entire composite layer is roughly equal to 400 angstroms or less" and "a thickness of the composite barrier layer does not exceed 400 angstroms" and that layer thickness is a result effective variable. Therefore, as reasoned from well established legal precedent, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that, in view of the applied prior art, the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Claims 21 and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hegde as applied to claims 20, and further in combination with Li (20030227068).

Hegde does not appear to explicitly disclose where one of the materials is scandium (Sc); where one of the materials is yttrium (Y); where one of the materials is lanthanum (La); where one of the materials is tantalum (Ta).

Nevertheless, as cited, Hegde discloses that the diffusion barrier is "any amorphous barrier layer." In addition, at paragraphs 10, 36, 37, 46, 59-63 and claims 65 and 178, Li discloses an amorphous diffusion barrier layer where one of the materials is scandium, yttrium, lanthanum and tantalum. Moreover, it would have been obvious to combine this disclosure of Li with the disclosure of Hegde because it would provide the "any amorphous barrier layer" of Hegde, and at a low cost.

To further clarify the disclosure of an amorphous barrier, as cited, Li explicitly discloses that the diffusion barrier where one of the materials is yttrium and tantalum is "amorphous." Further, as cited, Li discloses, "the barrier layer material can have a grain size of less than 1 nanometer." Therefore, Li discloses that the diffusion barrier grain size is zero nanometers, and the diffusion barrier having a zero nanometer grain size is inherently amorphous. In any case, it is not necessary to rely on the

disclosure of Li that the diffusion barrier is amorphous to properly combine Hegde and Li.

Claims 19, 20 and 22 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Chen (20040026119).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

At paragraphs 20, 25 and 26, Chen discloses a diffusion barrier comprising a plurality of stacked sub-layers 6, each sub-layer having a thickness of about 0.4 to about 4.5 nm, "about 50 angstroms" which is predetermined to inhibit the formation of a crystalline lattice, to inhibit diffusion of a chemical species through the diffusion barrier; wherein the sub-layers are comprised of alternating layers of at least two different materials (Zr and Cu); where one of the materials is copper (Cu) "ZrCuAl."

To further clarify the disclosure of alternating layers of at least two different materials (Zr and Cu), as cited, Chen discloses "a barrier layer comprising an amorphous metallic glass," and it is well settled that the term

"a" or "an" ordinarily means "one or more." Tate Access Floors, Inc., and Tate Access Floors Leasing, Inc., v. Interface Architectural Resources, Inc., 279 F.3d 1357; 2002 U.S. App. LEXIS 1924; 61 U.S.P.Q.2D (BNA) 1647 ((citing Tate Access Floors, Inc. v. Maxcess Techs., Inc, 222 F.3d 958, 966 n.4, 55 U.S.P.Q.2D (BNA) 1513, 1518 [\*\*32] (citing Elkay Mfg. Co. v. Ebco Mfg. Co., 192 F.3d 973, 977, 52 U.S.P.Q.2D (BNA) 1109, 1112 (Fed. Cir. 1999))). Indeed, Chen discloses, "one or more layers of tantalum-aluminum." Therefore, Chen discloses a barrier layer comprising alternating layers comprising an amorphous metallic glass. Furthermore, Chen discloses that the barrier layer is ZrCuAl. Hence, Chen discloses alternating layers of ZrCuAl. As a result, Chen discloses alternating layers of at least two different materials Zr and Cu.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hegde as applied to claim 20, and further in combination with Igarashi (6828189).

Hegde does not appear to explicitly disclose where one of the materials is an oxide.

Notwithstanding, as cited, Hegde discloses that the diffusion barrier is "any amorphous barrier layer." In addition, at column 4, lines 18-25; column 5, lines 5-9; and column 6, lines 15-24 and 56-59, Igarashi discloses an amorphous diffusion barrier layer where one of the materials is an oxide

"tantalum oxide." Moreover, it would have been obvious to combine this disclosure of Igarashi with the disclosure of Hegde because it would provide the "any amorphous barrier layer" of Hegde.

Applicant's amendment and remarks filed 4-27-6 have been fully considered, are addressed by the rejections *supra*, and are further addressed *infra*.

Applicant alleges, "The Examiner recognizes at page 6 of the Action [sic] that Hegde et al. do not disclose the claimed thickness limitations."

This allegation is respectfully traversed because there is no such recognition in the Office action. Rather, it is maintained in the rejection that Hegde discloses and anticipates the claimed thickness limitations, but, alternatively, "does not appear to disclose *verbatim* the claimed layer thickness limitations." [Emphasis added.]

Also, applicant argues that the particular claimed dimensional limitations are critical limitations because they produce unexpected results. This argument is respectfully traversed and deemed unpersuasive because criticality cannot be relied on to overcome a rejection based on anticipation. Specifically, Hegde anticipates the instant claimed range; therefore, Hegde inherently teaches the alleged criticality. Furthermore, applicant originally disclosed and presently discloses (see, for example, the abstract), and originally claimed embodiments of the invention not limited to the allegedly

critical limitations. Indeed, the claims were amended to include the allegedly critical limitations only after an office action rejecting the claims, and as indicated in MPEP 2164.089(c), "Broad language in the disclosure, including the abstract, omitting an allegedly critical feature, tends to rebut the argument of criticality."

In any case, it is respectfully submitted that criticality must be established by factual evidence, and not, as here, by mere argument. See, for example, *In re De Blauwe*, 736 F.2d 699, 222 USPQ 191, 196 (Fed. Cir. 1984), and MPEP 716.02(d), "Demonstrating Criticality of a Claimed Range." To establish unexpected results over a claimed range, applicants should compare a sufficient number of tests both inside and outside the claimed range to show the criticality of the claimed range. *In re Hill*, 284 F.2d 955, 128 USPQ 197 (CCPA 1960). To this end, the arguments of counsel cannot take the place of evidence in the record. *In re Schulze*, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965). Instead, the evidence relied on should establish "that the differences in results are in fact unexpected and unobvious and of both statistical and practical significance." *Ex parte Gelles*, 22 USPQ2d 1318, 1319 (Bd. Pat. App. & Inter. 1992). See also, *Ex parte C*, 27 USPQ2d 1492 (Bd. Pat. App. & Inter. 1992); *In re Nolan*, 553 F.2d 1261, 193 USPQ 641, 645 (CCPA 1977); and *In re Eli Lilly*, 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990).

In addition, applicant appears to argue that Chen discloses additional unclaimed limitations.

This apparent argument is respectfully deemed unpersuasive because Chen is not applied to the rejection for these unclaimed limitations.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

**For information on the status of this application applicant should check PAIR:**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

**Alternatively, applicant may contact the File Information Unit at (703) 308-2733. Telephone status inquiries should not be directed to the examiner. See MPEP 1730VIC, MPEP 203.08 and MPEP 102.**

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Any other telephone inquiry concerning this communication or earlier communications from the examiner should be directed to David E. Graybill at (571) 272-1930. Regular office hours:

Monday through Friday, 8:30 a.m. to 6:00 p.m.

The fax phone number for group 2800 is (571) 273-8300.

A handwritten signature in black ink, appearing to read 'DE Graybill', is positioned above the printed name.

David E. Graybill  
Primary Examiner  
Art Unit 2822

D.G.

5-Jul-06